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A NOVEL METHOD OF INTUBATION USING A LARYNGEAL MASK AIRWAY AND A BRONCHOSCOPE IN A PREMATURE INFANT

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ABSTRACT

We present a novel technique for securing an endotracheal tube after using a #1 Classic laryngeal mask airway (LMA) as a conduit for intubating the trachea of a premature infant. During induction of anesthesia for inguinal hernia repair in an ex- 23-week infant, an unanticipated difficult airway was encountered. After several unsuccessful attempts of intubating via direct laryngoscopy, we placed the endotracheal tube (ETT) into the trachea using a fiberoptic bronchoscope through a #1 LMA. A pediatric stylette, with Hytape ™ wrapped around the distal tip, was then used as a plunger to safely and easily remove the LMA from the mouth while maintaining the ETT in proper position. This technique is applicable in cases of a difficult neonatal airway where even a #1, the smallest LMA, is used.

Keywords: difficult neonatal intubation, laryngeal mask airway, fiberoptic intubation, difficult intubation

INTRODUCTION

Difficult airway management is well described in pediatric patients. An anticipated difficult airway can be planned in advance and preparations can be made to secure the airway safely in a number of ways (1). Unanticipated difficult intubation is a rare but potentially catastrophic event, especially in patients less than 6 months of age. In a situation of unanticipated difficult intubation, a common technique is to use a laryngeal mask airway as a conduit for endotracheal intubation in adults and children (2-5). This technique has also been used in infants and neonates, but the small lumen of the laryngeal mask airway can limit the size of the endotracheal tube that can be placed. Removing the laryngeal mask after successful endotracheal intubation is risky and can lead to the endotracheal tube becoming dislodged (6). Yet, leaving the laryngeal mask airway in place with the endotracheal tube can be unfamiliar to providers in the intensive care unit and also has the risk of the endotracheal tube becoming dislodged if the laryngeal mask airway moves. Unlike the Fastrach™ intubating LMA available for adult patients, there is no equivalent product available for the smallest patients (7). We present a novel technique for removing the laryngeal mask airway after successful intubation using the LMA as a conduit in neonates.

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CASE REPORT

A 100-day-old, 2600 gram, ex-24-week premature infant was scheduled for a bilateral inguinal hernia repair. The infant had a previous history of respiratory distress syndrome (RDS) and a patent ductus arteriosis (PDA) that had resolved without surgery. He had a short course of intubation and mechanical ventilation at birth and had an on-going requirement for oxygen via nasal cannula. After consent for surgery was obtained, he was fasted for 6 hours and taken to the operating room for his surgery. Routine ASA monitors were placed and he was pre-oxygenated with 100% oxygen. Anesthesia was induced via the circuit with 100% oxygen and sevoflurane 4%. Once mask ventilation was established, cis-atracurium 5 mg was given intravenously. Mask ventilation was easy, and laryngoscopy was performed by the anesthesia resident with a Miller 0 blade. After a failed attempt at intubation due to the inability to visualize the glottis, two attempts were made by

the attending pediatric anesthesiologist and one final attempt was made by a second attending pediatric anesthesiologist. The vocal cords were visualized by both attendings, but the ETT would not pass through the glottis. The baby was repositioned between attempts and a 2.5 ETT was used on the final laryngoscopy, but the ETT could still not be passed. Mask ventilation remained easy, and a discussion ensued about whether to cancel the case and return another day with a different plan. We placed a #1 LMA to allow for easier ventilation of the baby until the muscle relaxant could be reversed. Two milliliters of air were placed in the cuff to allow for an ideal fit.

After placing the LMA the baby continued to be stable. We elected to try one more attempt at intubation. A 2.2-mm bronchoscope, with a 2.5 uncuffed ETT loaded onto it, was inserted into the LMA and manipulated through the glottis into the trachea. With a small amount of silicon lubricant applied to the system, the ETT slid easily off the bronchoscope into the trachea. The 15-mm adapter was re-attached to the ETT and bag ventilation was performed. Return of carbon dioxide and auscultation of breath sounds confirmed tracheal placement of the ETT.

After a period of ventilation, to maximize de-nitrogenation, we removed the LMA from the mouth using the following technique. We took a standard pediatric stylette (Rusch Slick stylette small #500) and wrapped a small amount of Hytape™ around the end (Figure 1; the amount of tape required was 3-4 revolutions for a 2.5mm ETT, 5-6 revolutions for a 3.0 mm ETT). We then took the stylette with the tape plug and inserted it in to the proximal end of the ETT (Figure 2.) Once it was in place we held gentle pressure on the stylette while pulling the LMA back over the tube (Figure 3.) After the LMA was out of the way, we connected the 15-mm adapter and hand-ventilated the baby. We then rechecked end tidal CO_2, ETT position and breath sounds to ensure the ETT had remained correctly positioned in the trachea, after which it was taped in place. There was a large leak around the 2.5 ETT, but the baby was able to adequately ventilated. The ETT was secured and the hernia repair was done without incident. The baby was extubated in the NICU one hour after surgery without complications.

DISCUSSION

LMAs have been used for many years to facilitate fiberoptic intubations. They have proven especially valuable in cases where mask ventilation is difficult (8) or when a patient requires ventilation during a fiberoptic intubation (9). There are reports of using an LMA as a conduit to intubate infants (10), however; the small size of both the baby and the #1 LMA creates difficulty with both the intubation and the LMA removal afterwards. Even when uncuffed ETT are placed through small LMA's, the ETT size is a factor due to the limited surface area between the two pieces of equipment. During the creation of this report we tested ETT sizes using a #1 LMA and found only a *2.5, or a 3.0 uncuffed ETT* can be passed through easily. A 3.5 mm ETT does not pass through a standard #1 LMA. A 3.0 cuffed ETT can be passed but the pilot balloon will not be able to be removed. Even with limited choices for ETT's, the LMA does position the bronchoscope directly toward the glottis, and allows for easy ventilation between attempts.

Once endotracheal intubation through the LMA is accomplished, securing the ETT then becomes the primary focus. If the case is short, or no post-op ventilation is required, the LMA can be left in place with the endotracheal tube in-situ. In other cases it is usually desirable to remove the LMA from the mouth. Techniques to accomplish this have been described in the literature (10-14). Osses et al (14) reported a similar technique to what we report, using an adult intubating stylette to push the ETT off the LMA, with several important differences. In the Osses paper, a blind technique of intubation was used to place the ETT into the trachea through the LMA. In our experience this is difficult in the smaller infants, and failed attempts can create laryngeal edema compromising patency of the airway. In addition, the Rusch large adult stylette does not fit snugly in all ETT's except the 2.5mm, making use of tape, as described in our report necessary. If one uses the technique described by Osses et al, the ETT will not stay attached to the stylette, which could lead to failure. Using tape to secure the stylette, as we describe, creates a system that can be used with every ETT size, and can be easily adjusted by adding extra revolutions of tape around the end, making this technique fully viable for all

ETT/LMA combination of sizes. We also tried the combination a Rusch small or medium size stylette and found it works with either a 2.5 or 3.0mm ETT. A Rusch large will work as well, and fits snugly in a 2.5 mm ETT without tape.

Another technique described in the literature uses a recent innovation, the air-Q intubating laryngeal airway, which is similar but with some useful modifications from a standard LMA (15). These include a curved shape, short external tube, and grill-less airway outlet. Using the air-Q is helpful because the short external tube allows the air-Q to be removed from the patient leaving the ETT in place. Its use has been described in small children, but others have reported difficulties using the air-Q in neonates, noting the device's placement has failed in small babies (16).

Other techniques to remove the LMA, include using two ETTs, or placement over a guidewire, Bougie, or airway exchange catheter (11-13, 17). The two ETT technique can be limited in the smallest of children as the second ETT must be smaller than the first. Also, there is a concern about the 2 ETTs separating, causing failure to secure the airway. The exchange catheter technique is viable potential option in some infants, but it can not be used with a 2.5 mm ETT as the Cook 8 French catheter does not fit through this size ETT. In addition, as described in their report, the ETT can still dislodge and need to be re-threaded over the catheter, making the technique more complicated, and potentially hazardous. The remaining techniques require additional equipment that may not be easily available during an unexpected difficult intubation.

One author recommends just removing the LMA while the fiberoptic bronchoscope is in the trachea during the intubation (18). They describe pulling the LMA out leaving the FOB in, and then re-advancing the ETT back in the trachea if it comes out. We do not advocate this technique, due to the risk of losing the FOB out of the trachea during the process, while using a very thin and flimsy 2.2mm bronchoscope.

In summary, we describe a simple technique, with readily available equipment for removal of an LMA from the oropharynx after endotracheal intubation in neonatal patients. Hytape™ and a pediatric stylette are common pieces of equipment used during pediatric anesthesia and should be readily available at any location in which a difficult intubation is encountered.

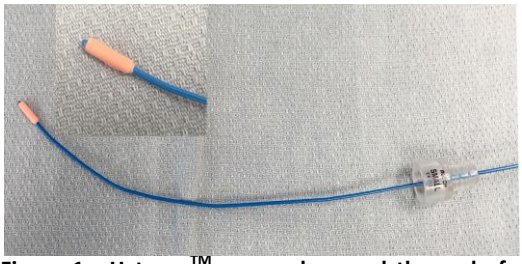

Figure 1 : Hytape ™ wrapped around the end of a pediatric stylette to create the 'plunger' for LMA removal over the ETT. It takes 3-4 revolutions of tape for a 2.5mm ETT and 5-6 revolutions for a 3.0mm ETT

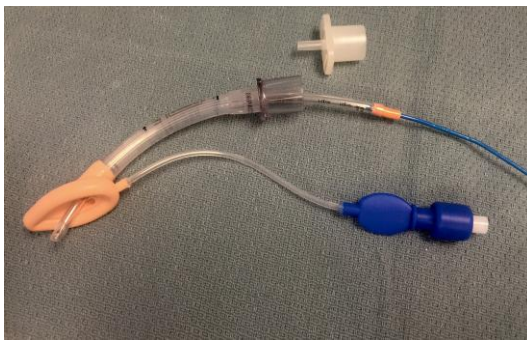

Figure 2 : Stylette inserted into the end of the ETT. Care should be taken to ensure silicon lubrication is used and there is adequate fit.

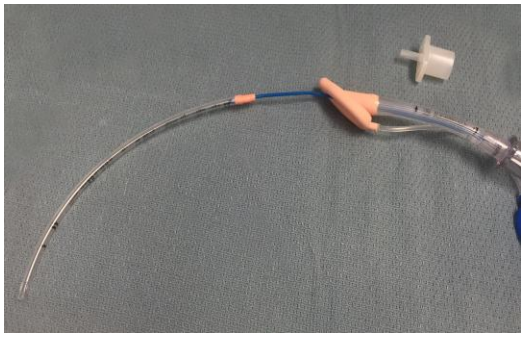

Figure 3 : LMA removed keeping ETT in situ. Care should be taken to keep the ETT in proper position, noting the distance on the tube relative to the gums, and confirm placement with breath sounds and end-tidal CO_2.

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